Course Specifications

Course Title:	**Polymer Chemistry**
Course Code:	**4024581-3**
Program:	**Pure Chemistry**
Department:	**Chemistry**
College:	**Applied Science**
Institution:	**Umm Al-Qura University**

Table of Contents

A. Course Identification

1. Credit hours: 3
2. Course type **a.** University ☐ College ☐ Department ■ Others ☐ **b.** Required ■ Elective ☐
3. Level/year at which this course is offered: 8st level / 4th year
4. Pre-requisites for this course (if any)**: Petroleum chemistry (4024572-3)**
5. Co-requisites for this course (if any)**: not applicable**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	√	100%
2	**Blended**		
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	30
2	**Laboratory/Studio**	45
3	**Tutorial**	---
4	**Others** (quizzes and exams)	6
	Total	81
Other Learning Hours*		
1	**Study**	45
2	**Assignments**	10
3	**Library**	6
4	**Projects/Research Essays/Theses**	4
5	**Others** (quizzes and exam preparation)	16
	Total	81

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description

Polymer chemistry is a multidisciplinary science that deals with the study of physical properties, chemical synthesis and chemical properties of different types of polymers. This polymer chemistry course covers the study of physical properties and synthetic techniques in common use in both academic and industrial laboratories for making a wide variety of polymers.

2. Course Main Objective

This course aimed to study the preparation of polymers as well as understanding their physical and mechanical properties, applications, and its economic importance.

3. Course Learning Outcomes

CLOs		Aligned PLOs
1	**Knowledge:**	
1.1	Identify the basic principles of polymer classification	K1, K3
1.2	Identify different methods to determine the molecular weight of polymers	K2
1.3	Recognize the different methods used in the preparation of polymers	K4
1.4	Write the products of polymerization reaction correctly	K1
1.5	Recognize the different types of polymers	K3
1.6	Determine the type of mechanism of polymerization reactions	K4
1.7	Familiar with the basic knowledge about the thermal transitions of polymers	K5
1.8	Familiar with the basic knowledge about the importance and applications of polymers in industry	K6, K7
1.9	Familiar with the mechanical properties of different polymers	K5
2	**Skills:**	
2.1	Explain the physical properties of polymers	S1
2.2	Compare between the different methods of polymerization	S4
2.3	Apply the gained knowledge and understanding to determine the molecular weight of polymers	S2, S3, S7
2.4	Explain the reaction mechanisms for different polymerization reactions	S3
2.5	Summarize the different methods used to synthesis of different types of polymers	S4
2.6	Explain the factors affecting glass transition state (T_g) of polymers	S2
2.7	Apply the different laboratory techniques to synthesis of polymer molecules	S4

CLOs		Aligned PLOs
2.8	Predict the future applications of polymers	S1, S2
2.9	Interpret chemical data	S4, S6
2.10	Evaluate the different methods to synthesis of different types of polymers	S4
2.11	Demonstrate a synthetic pathways for synthesis of polymer molecules	S1, S4
2.12	Work effectively both in a team and independently to perform a specific experimental tasks	S8
2.13	Recognize the different applications of polymers in industry	S1, S2, S4
3	**Competence:**	
3.1	Enhance the ability to use computers and internet	C3, C4
3.2	Present chemical data orally.	C1
3.3	Apply his knowledge to write a chemical report	C1, C2, C3
3.4	Able to share results to classmate and participation in class or laboratory discussions	C1, C2

C. Course Content

No	List of Topics	Contact Hours
1	Introduction and definitions	2
2	Basic principles of polymer classification – Polymer architecture – Types of polymers	4
3	Molecular weight of polymers	2
4	Condensation polymers - addition polymer	4
5	Mechanisms of polymerization reactions - copolymerization	2
6	Physical properties of polymers	4
7	Thermal transitions of polymers: glass transition state Tg – factors affecting on T_g.	4
8	Polymer uses and future applications	4
9	Mechanical properties of polymers	2
10	Industrial synthesis of polymers and technology	2
Total		30

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1	Identify the basic principles of polymer classification	Lectures	Quiz. Final exam.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.2	Identify different methods to determine the molecular weight of polymers	Lectures. Web based study. Library visit.	Quiz. Final exam
1.3	Recognize the different methods used in the preparation of polymers	Lectures. Lab work.	Quiz. Lab exam.
1.4	Write the products of polymerization reaction correctly	Lectures.	Quiz. Final exam.
1.5	Recognize the different types of polymers	Lectures. Library visit.	Quiz. Final exam.
1.6	Determine the type of mechanism of polymerization reactions	Lectures.	Final exam.
1.7	Familiar with the basic knowledge about the thermal transitions of polymers	Lectures.	Final exam.
1.8	Familiar with the basic knowledge about the importance and applications of polymers in industry	Lectures. Web based study. Library visit.	Final exam
1.9	Familiar with the mechanical properties of different polymers	Lectures. Web based study. Library visit.	Final exam. Lab report
2.0	**Skills**		
2.1	Explain the physical properties of polymers	Lectures. Lab work.	Lab report. Lab exam.
2.2	Compare between the different methods of polymerization	Lectures. Lab work.	Lab exam. Final exam.
2.3	Apply the gained knowledge and understanding to determine the molecular weight of polymers	Lectures.	Final exam.
2.4	Explain the reaction mechanisms for different polymerization reactions	Lectures.	Final exam.
2.5	Summarize the different methods used to synthesis of different types of polymers	Lectures. Lab work.	Final exam. Lab exam.
2.6	Explain the factors affecting glass transition state (T_g) of polymers	Lectures.	Quiz. Final exam.
2.7	Apply the different laboratory techniques to synthesis of polymer molecules	Lab work.	Lab exam.
2.8	Predict the future applications of polymers	Web based study. Research activity.	Class discussion.
2.9	Interpret chemical data	Lab work	Lab exam
2.10	Evaluate the different methods to synthesis of different types of polymers	Lab work.	Lab exam.
2.11	Demonstrate a synthetic pathways for synthesis of polymer molecules	Lectures. Lab work.	Final exam. Lab exam.

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
2.12	Work effectively both in a team and independently to perform a specific experimental tasks	Lab work.	Lab exam.
	Recognize the different applications of polymers in industry	Web based study. Research activity.	Class discussion.
3.0	**Competence**		
3.1	Enhance the ability to use computers and internet	Research activity. Web based study.	Portfolios
3.2	Present chemical data orally.	Class discussion.	Class discussion
3.3	Apply his knowledge to write a chemical report	Research activity.	Portfolios
3.4	Able to share results to classmate and participation in class or laboratory discussions	Class discussion.	Class discussion

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Mid-term exam	8-10	20%
2	Assignments and activities		5%
	Quizzes and class discussions		5%
3	Practical Exam	15	30%
4	Final Exam.(2 hours exam)	16	40%

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:

- **We have faculty members to provide counseling and advice.**
- **Office hours: During the working hours weekly.**
- **Academic Advising for students (about 20-25 student/ one faculty member).**

F. Learning Resources and Facilities

1.Learning Resources

Required Textbooks	John McMurry's "*Organic Chemistry, 8th edition, International Edition*" **2011**, Brooks/Cole.
Essential References Materials	1. L. H. Sperling, *Introduction to Physical Polymer Science*, 4th Edition, Wiley, **2006**.

	2. I. M. Ward and J. Sweeney, *An Introduction to The Mechanical Properties of Solid Polymers*, 2nd Edition, Wiley, **2004**. (TA455.P58 W36 2004). 3. Stanley R. Sandler, *Polymer Synthesis*, Vol. III, Academic Press, **1980.**
Electronic Materials	• Lecture Hand-out available as a PowerPoint presentation. • http://www.chemweb.com • http://www.sciencedirect.com • http://www.rsc.org
Other Learning Materials	

2. Facilities Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	• Classrooms capacity (30) students. • Providing teaching halls including computers and projector.
Technology Resources (AV, data show, Smart Board, software, etc.)	Teaching halls equipped with computer and data show.
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	No other requirements.

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Effectiveness of teaching and assessment	Program leader	Direct
Extent of achievement of CLO's	Peer Reviewer	Direct
Quality of learning resources	Students and Faculty members	Direct

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	

Received by: Dr. Ismail Althagafi **Department Head**

Signature:  **Date: 20/12/2019**